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Reflections and Encounters: Exploring Awareness in an Academic Environment

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Abstract. Earlier work within the CSCW community treated the notion of awareness as an important resource for supporting shared work and work-related activities. However, new trends have emerged in recent times that utilize the notion of awareness beyond work-related activities and explore social, emotional and interpersonal aspects of people's everyday lives. To investigate this broader notion of awareness, we carried out a field study using ethnographic and cultural probe based methods in an academic setting. Our aim was to study staff members' everyday activities in their natural surroundings; understand how awareness beyond work-related activities plays out and how it is dealt with. Our field study results shed light on two broad and sometimes overlapping themes of interaction between staff members: 1) self-representations and 2) casual encounters. We provide examples from the field illustrating these two themes. In general, our results show how awcreness is closely associated with people's everyday lives, where they creatively and artfully utilize ordinary resources from their environments to carry out their routine activities. Using the results of our field study, we describe the design of a situated display called Panorama that is meant to support non-critical, non-work-related awareness within work environments.

Key words: Awareness, CSCW, work environment, ethnography, design

1. Introduction

Designing for 'awareness' within public and private settings has been an important topic of the Computer Supported Cooperative Work (CSCW) research. Schmidt (2002)) points out that the concept of awareness has provided a vehicle to address the complex processes of organizational interaction that enable actors subtly and unobtrusively coordinate their actions and activities with one another. The seminal ethnographic studies of the London Underground control room by Heath and Luff (1992) and air traffic control work by Lancaster University's CSCW group (Harper et al. 1989; Hughes et al. 1992) illustrated how actors 'pick up' cues, traces and signals about complex work-related activities from information rich environments and coordinate their ongoing joint efforts. Early technologies to support awareness, such as media spaces (Bly et al. 1993), have often been specialized for mediating selective work-related activities and relationships, through computationally integrated audio-video links between geographically dispersed co-workers (Dourish and Bly

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1992; Gaver et al. 1993). Here awareness is seen to be supported by facilitating informal chat and discussions between remotely located colleagues, providing an idea of what is going on at the other end and supporting other social interactions in an informal way. More recently, awareness technologies for work environments such as @Work (Tollmar et al. 1996), Kandinsky system (Fogarty et al. 2001), Hermes (Cheverst et al. 2009), Elvin (Fitzpatrick et al. 2002), Ambient Agoras (Streitz, et al. 2007) have been developed to convey information about co-workers' presence, their on-going activities and their personalized messages. The scope of technology design is broadening with the growing interest and need to support personally meaningful, authentic, sociable and rich everyday experiences. The notion of awareness has also evolved from the objectively observable aspects encompassing information mainly about the work-related and productive aspects of peripheral settings to conveying subjective aspects such as love and intimacy (Chung et al. 2006; Kaye and Goulding 2004; Vetere et al. 2005), playfulness (Battarbee et al. 2002; Gaver et al. 2003; Sellen et al. 2006a, b) and other related issues. Focusing on this type of awareness, sometimes referred to as provocative or affective awareness, Gaver (2002) emphasized that awareness systems should convey information imprecisely so that "hints or clues about other people's activities may be as effective, and more emotionally satisfying, than more complete information in evoking experiences of connection." Gaver also emphasized the potential of designing awareness systems that can utilize a wider range of sensory and aesthetic interactions.

In large organizations, awareness is sometimes neglected in the tension between heavy workloads, time clashes, a lack of social encounters between employees, exacerbated by a lack of suitable platforms that allow one to construct and convey one's identity (Bødker and Christiansen 2006). The usefulness of 'informal interaction' at workplaces has been emphasized since Roy's (1959) work. The work of Nardi et al. (2002) showed that professionals create their own network of people going beyond their workplace and profession, and utilize these networks as and when needed. Recently, several CSCW studies have explored the role of social networking services (SNS) in work organizations: investigating different motivations of employees for social networking at workplaces (DiMicco et al. 2008), exploring how multiple SNS are managed (Rooksby and Sommerville 2012), and exploring how individuals manage their identity over SNS platforms such as Facebook (DiMicco et al. 2007). A five-year-long study that drew the comparison across the use of multiple SNS platforms such as Facebook, Google+, FourSquare, Instagram and Pintrest (Zhang et al. 2014) showed how people are getting used to multi-layered social networking and how their expectations and privacy concerns have evolved. Large corporates have realized the value of social networking and informal interactions at work, for example, IBM have attempted to explore this phenomena using tools such as SocialBlue (formally IBM Beehive) (Wu et al. 2010) and Honeycomb (van Ham et al. 2009) in their own organization.

This paper aims at exploring awareness practices of staff members in an academic department. We focus on the non-critical and the softer side of staff members'

everyday interactions, going beyond the productivity and instrumentality of the academic profession. We believe that, by developing such an account of how staff members become socially aware of each other, we can provide useful understanding about how to support community building in work environments through technological means. In order to study the awareness of non-critical and non-work aspects, we carried out a naturalistic, in-situ exploration of an academic department. We used a varying set of methods such as contextual interviews, naturalistic observations and an adapted version of the cultural probes method (Gaver et al. 1999) to understand staff members' current practices of being socially aware of others and of the environment as a whole. Our approach in the fieldwork was focused on understanding social interactions limited not only to work or routine activities but also sentimental, pleasure and play related acts.

Note that our study is of a largely un-augmented physical office space. This is in contrast to media spaces (Bly et al. 1993) and other forms of technologically mediated communication awareness systems, which augment shared physical spaces (Cheverst et al. 2009; Streitz, et al. 2007) and social networking systems, which create alternative virtual spaces (Wu et al. 2010). In our case, the dominant means of awareness are doors, paper, notice boards and face-to-face interaction. However, we hope that the understanding we gain through studying the artful ways people use these physical spaces and objects to achieve social awareness, can be used to inform the design of technical systems.

The results of our field study were analyzed using inductive coding; this showed that staff members' everyday practices to support awareness fall within two broad themes: Self-representation and Casual Encounters. *Self-representations* are a varied set of attempts from staff members to represent and express themselves by letting others know about their choices, preferences, identity, and other more practical information by intentionally and unintentionally making their status information, personal details, announcements and expressions publicly available in the department. *Casual encounters* are a set of activities by which staff members, during their everyday activities, intentionally or unintentionally, interact with other members and objects within the surroundings that provided hints and cues of each other's awareness. In this paper, we elaborate on these two themes and provide examples from the field. We believe that these two themes are quite generic and can be used to inform the design technologies for supporting mediated awareness in work environments.

In the rest of the paper, we begin by providing an account of awareness and its connection to the CSCW research and briefly describe previous work on awareness. We then describe the methods used in our field study and details of our participants. We then provide our results focusing on the two themes of interaction for supporting awareness in work environments: Self-representation and Casual Encounters. We provide several examples from the field to provide different patterns within these themes. Finally, we draw out more precise design implications of the themes which in turn informed the design of an awareness system called Panorama.

2. Awareness

Awareness is one of the central topics in the CSCW research. While people go about carrying out their everyday activities, they maintain awareness of things around them, which amounts to an understanding of what others are doing, where they are or what they say. This understanding can help people in making inferences regarding intentions, actions or even emotions of others and provide a context for their shared activities and social interactions (Markopoulos et al. 2009). It is suggested that participants' being aware of each other's conduct and interaction has a great importance for the design and development of technologies to support collaborative work (Schmidt 2002; Robertson 2002). In the context of collaborative work settings, the idea of awareness rests on the participants' abilities to remain sensitive to each other's conduct while being involved in their distinct individual activities (Heath and Luff 1992). The real challenge here is, as Schmidt (2002) points out, to understand how co-workers effortlessly pick up these cues and signals about what is going on around them and make practical sense of it. In order to design a system that can support awareness among co-workers, we need to take into account diverse coordinative practices through which cooperative work is routinely and seamlessly integrated. These coordinative practices differ from domain to domain. A firm grounding into these practices, however, is essential to good technology design.

In the literature, there are two different ways awareness is conceptualized. One, where concerned participants are co-located and working towards achieving a common goal, for example in a control room or at a cubical office space. And second, where participants are remotely located and are attempting to collaborate via some kind of technological support (e.g., an audio-video linked communication setup). These two scenarios require different treatments of the term awareness. In the scenario of co-located settings, awareness is realized through unobtrusive practices (such as, overhearing) through which cooperative activities are somehow implicitly and unremarkably aligned and integrated into participants' ongoing activities (Heath and Luff 1992). In the scenario of remotely-located settings, certain activities are deliberately carried out (such as, typing an instant message on IM) that might interrupt other participant's flow of activities (Nardi et al. 2000). Schmidt (2002)) remarks that the notion of awareness is used in increasingly contradictory ways. In our research, we are mainly looking at the co-located settings. We conceptualize awareness as a product of both implicit and explicit actions and a skillful practice that is aligned into the everyday work of participants. Even though our research focuses on people's co-located interactions, for the sake of a better understanding of the term awareness, we briefly discuss what awareness in remote collaborative settings mean. It is also, however, important to note that the aforementioned description of awareness is only a specific kind of interpretation awareness.

2.1. Characteristics of awareness

Schmidt (2002) has reported several important characteristics of awareness. We summarize some of these in the following points.

1. **Awareness is a product**. Being aware of something is a state when one is in procession of knowledge or information about something or somebody. Through one's implicit or explicit actions one becomes aware of something or tries to make someone else become aware. This way, awareness is a product not a process. As researchers, we can only access awareness indirectly, through the analysis of space, mediators, and human conduct and culture (Bødker and Christiansen 2006). In cooperative work scenarios, sometimes, people become aware of each other's acts implicitly and without negotiation or other forms of focused interaction, that it is *as if* their distributed activities are 'seamlessly' integrated. Heath and Luff (1992) showed in their London Underground control room study that co-workers' 'overhearing' supported a kind of awareness between controller and divisional information assistants which lets them coordinate and control their ongoing work.
2. **Awareness is a skillful practice**. Awareness is a class of highly active and skilled practices. Actors scan for certain cues and traces of the state of an ongoing work that could help them understand what is happening and inform their future activities. It is not a 'state of mind', but an attribute of observable action that is systematically accomplished during the course of actors' everyday activities. Actors apply skillful ways to design and produce actions to render features of their conduct selectively available to others. These actions may be intended for selected persons or for all the co-located people in general. The ways in which individuals accomplish awareness is inextricably embedded in the activities in which they are engaged, and the ways in which those activities necessarily entail particular practices and procedures.
3. **Awareness is about *displaying* and *monitoring***. The ways in which cues, traces and indications of work-related activities are 'displayed' and 'monitored' are central to awareness. In fact, displaying and monitoring are complementary aspects of awareness. On the one hand, actors typically adjust and design their own activities in such a way that their co-workers and other relevant personnel are provided with cues, traces and other kind of resources that may be relevant for ongoing activities. This particular attribute of their practice can be called 'displaying'. On the other hand, actors scan, observe, or listen to the activities of their colleagues in order to determine the state, progress and direction of ongoing activities. This aspect of their practices can be called 'monitoring'. Displaying and monitoring are thus complementary aspects of the same coordinative practices. This also indicates that awareness is inherently of a 'social' nature, as it involves conveying or notifying others and vice versa.
4. **Awareness is about 'exploiting what is already there'**. In coordinating activities with their co-workers or conveying the status of ongoing work, actors

try to gather cues, traces and indications from established practices and the current state of their ongoing work. They do not put extended effort into exploring awareness related information, instead they try to infer it from the status of the environment. This indicates that awareness is an integral aspect of people's situated actions and is not a dedicated action. This way awareness is 'ongoingly' achieved in collaboration with others. Awareness is awareness of actions and changes in the state of work (or any other situation).

5. **Work and workplace settings determine awareness**. When engaged in a cooperative effort, actors are objectively and materially interdependent. Their interdependence inescapably has causal aspects, and their actions and interactions are thus both intentional and material. The physical setting of a workplace and the nature of a particular work afford as well as constrain awareness. Workplace settings support awareness among a group of people via visual, audible and movement-based cues. Heath and Luff (1992) use the notion of 'centers of coordination' (originally coined by Suchman (1997)) to refer to specific work settings (e.g., control rooms) that have particular characteristics which make them suitable for individuals' ongoing monitoring of each other's conduct whilst engaged in distinct but related activities.
   The nature of work itself also plays an important role in supporting or hindering awareness. The work of architects, engineers and designers would be represented externally in the form of artefacts such as sketches, drawings and 3D models, whereas the work of accountants and stock brokers will be represented in the form of papers, excel sheets and in other digital forms. As Schmidt and Wagner (2002) points out these artefacts play an important role in supporting awareness and coordination among a group of co-workers.

2.2. Early work on awareness

The earlier technologies that were used to convey awareness through closely coupled audio-video links between offices were termed 'media spaces' (Dourish and Bly 1992; Bly et al. 1993; Gaver et al. 1993). Their initial use was to connect work between geographically dispersed offices and work environments. The main expected benefit of using media spaces was to support productivity in work environments by creating possibilities to engage in task-oriented conversations from a distance and, at the same time, to have a general orientation to the presence and activities of colleagues at the other end. Awareness from this perspective is defined as the following:

> *"Awareness involves knowing who is 'around', what activities are occurring, who is talking with whom; it provides a view of one another in the daily work environments. Awareness may lead to informal interactions, spontaneous connections, and the development of shared cultures – all important aspects of*

> *maintaining working relationships which are denied to groups distributed across multiple sites."*
>
> – Dourish and Bly (1992, p. 541)

Through media spaces, it was assumed that geographically dispersed office members would work as if they were at the same place. Unfortunately, these assumptions never materialized (Schmidt 2002). Most awareness systems developed to support the work environments focused predominantly on productivity aspects of users' everyday work life. For example, in some recent examples of awareness systems (e.g., McCarthy et al. 2001; Redström et al. 2000; Tollmar et al. 1996) awareness is supported through providing indications about the presence of colleagues, availability of their biography, their project descriptions, information about their daily schedules and office calendars. Novel representation mechanisms are also explored to provide more 'glanceable' information about co-workers, their presence and activities. In the design of the Hello.Wall (Streitz et al. 2005) installation, abstract representations were used so as to have unobtrusive interaction with remote colleagues – following the notions of calm computing (Weiser and Brown 1996).

2.3. Awareness beyond work-related activities

With the emergence of novel computing technologies such as ubiquitous computing (Weiser 1991) and ambient intelligence (Aarts and Marzano 2003), the focus of technologically mediated awareness has shifted from supporting work-related activities to mundane everyday interactions. The scope of awareness has extended from merely supporting productivity and efficiency to conveying users' emotions, love, social status and other broader social and cultural aspects. Gaver suggests that, as the context in which these (awareness) technologies are used changes, the form and ways to interact with these technologies should also change (Gaver 2002).

In domestic environments these technologies are used to convey, for example, emotional connections between distant lovers (Chung et al. 2006; Kaye and Goulding 20044; Strong and Gaver 1996; Vetere et al. 2005), awareness within families (Hindus et al. 2001; Hutchinson et al. 2003; Taylor et al. 2006) and ways to keep in touch with family from a distance (Markopoulos et al. 2004; Mynatt et al. 2001). In public domains, these technologies are used to establish playfulness and evocative interactions between strangers (Battarbee et al. 2002; Gaver 2002), developing social and cultural respect within a large community (Gaver et al. 1999), among many others. Even in office environments these technologies are deployed for exchanging information about the moods and attitudes between co-workers (Sengers et al. 2005; Streitz et al. 2005). Technologies that support awareness have also been used in the domain of healthcare to support remote communication between aging elderly to their families and others. For example, markerClock system (Riche and Mackay 2010) allowed the elderly to establish awareness about the rhythms and

routines of their peers to support mutual care amongst those in a similar situation. All these systems embody certain assumptions about the basic objectives for conveying awareness, the information that should be conveyed and the media through which this might be conveyed.

We have provided a limited literature on awareness and systems that support awareness. A detailed review and range on topics related to awareness can be found in Markopoulos et al. (2009) book "Awareness Systems".

3. Studying awareness in an academic department

In order to explore awareness beyond work-related activities, we studied one of our own academic departments using ethnographic methods. Academic environments represent an interesting case where routines and rhythms of staff members' activities are not rigid, as opposed to what has been shown in the traditional CSCW studies on control rooms, for example. We chose to study our own work environment because we aimed to design a technology that can allow staff members of our department to be aware of one another's activities and interests beyond work. Over a period of 3 months, two researchers[1] studied the department using ethnographic and cultural probe methods. Parts of the study results are presented in (Vyas et al. 2007) and (Vyas et al. 2008).

Our department was divided over three floors, where in total 6 research groups were active when we carried out our investigation. The department incorporated around 200 employees, including professors, PhD students, researchers, programmers and administrative staff. Different facilities in the department such as post boxes, printing, meeting rooms, conference rooms, and canteen were divided over these three floors.

As a first step towards exploring mediated awareness in a co-located academic department, we sought to understand staff members' current practices within the department and how that leads to awareness. We carried out an ethnographic field study utilizing methods such as naturalistic observations, contextual interviews and organizational probes (Vyas et al. 2008) – an adapted version of the cultural probes method by Gaver et al. (1999) and informational probes approach described in (Crabtree et al. 2003). In the following we provide details of the methods we used and participants of our study.

3.1. Ethnographic field study

Our ethnographic fieldwork was aimed at studying staff members' everyday activities and, in particular, how awareness was being supported through different means. As mentioned earlier, we aimed to observe their non-critical and non-work-related

[1] One of the researchers is the first author of this paper.

activities to be able to understand the emotional and pleasure-centric aspects of our department. We limited the scope of our research by focusing on the non-technological ways staff members conveyed their awareness related cues. We took inspirations from the Interaction Analysis[2] method developed by Jordan and Henderson (1994). Interaction Analysis is an interdisciplinary method to investigate interactions of human beings among themselves and with objects in their environment. Even though this technique was originally used for video analysis, it provided us with a number of useful foci for understanding the awareness phenomenon in an academic environment. We focused our exploration on the following categories:

- Forms of awareness
- Activities of awareness
- Agents of awareness
- Places of awareness
- Contents of awareness

Forms of awareness describe different methods of communication that are used for mediating awareness information. These can be either synchronous (e.g., face-to-face, phone calls) or asynchronous (e.g., e-mail, instant messaging tools, post-it notes). The methods for communicating awareness information can be explicit, providing direct indications, or implicit, leaving room for multiple interpretations.

Activities of awareness describe the type of activities within the environment that could mediate awareness information. These can be task-oriented (i.e., a routine work activity) or social in nature (i.e., lunch, coffee break). Often these activities overlap so it is important to take into account the possible relationships between different activities.

Agents of awareness are the people and the objects or artefacts within the environment that mediate awareness, directly or indirectly. People can be seen as individuals and also as constituting groups (e.g., research groups). In this case it is important to understand the roles that the ethical and political issues (e.g., position hierarchy) play in contributing to awareness. We also need to take into account the role of students in forming awareness within our educational environment.

Places of awareness, in a broad sense, describe the geographical as well as the 'social spaces' where interactions take place, including the hot spots of interaction. This can be seen as a multi-layered concept: personal vs. private spaces of staff members within an office, a floor, a building and the whole environment. Inherent to the observations made in this category of awareness is the question: "how does the spatial layout influence the structure of interaction?"

Contents of awareness refer to the actual information being mediated through different interactions. Contents of awareness can be staff members' activities,

[2] The Interaction Analysis method was used to guide our observations and interviews. As such no video ethnography was carried out.

presence, social and political status, achievements, and so on. This can be explicit (i.e., a note saying that a person will be back at a certain time) and implicit (i.e., artefacts used as symbols or the information at a 'glance'). Both are open to different interpretations by different people, the implicit content being more so.

Using these categories as a base for our exploration, we used three methods: naturalistic observations, contextual interviews and organizational probes (Vyas et al. 2008).

In order to understand the social dynamics within our department, we recruited 10 staff members from our department to carry out contextual interviews. We asked them questions related to their everyday interactions within the department. A few of the example questions: What type of information would the staff members in our department like to know about other members? What types of information would they be willing to share with others? What were their privacy concerns? What common areas in the department did they often use to gather information about others? What were the common tools of communication they used outside their offices? Especially in the staff room, what were the most common activities performed by the members and how often? And lastly, how important was being socially aware of other members in the department? The information was recorded in an audio device and written notes were also taken.

In the naturalistic observations, we used video and still cameras to capture staff members' activities in the staff room, the printing-room, the canteen and other common areas where social communication happens. One of the authors spent several hours during a week and noted staff members' everyday activities and their social encounters. Using a video camera, we also followed some of our colleagues to get insights into their everyday interactions, for example, walking to the canteen, to the printer room and to the staff room.

3.2. Organizational probes

In addition to the contextual interviews and naturalistic observations, we also wanted to get an account of staff members' everyday experiences, the impact of their work environment on their social wellbeing and their emotional and subjective attachment with the department. Contextual interviews and naturalistic observations could inform us more about what people do and less about how they feel, hence, we developed a set of 'organizational probes' to understand employees' everyday experiences – a technique inspired by the cultural probes method (Gaver et al. 1999) and informational probes approach (Crabtree et al. 2003). Cultural probes are a collection of specialized tools containing open-ended, provocative and oblique tasks to support participants' engagement with the design process. It is an interpretive approach to generate design inspirations rather than a data collection method (Boehner et al. 2007). Our goal to build on an approach such as this was to explore social and playful practices of staff members and to enable them to participate in the design process in an accessible way and reflexively trigger a design dialogue that

correlated with their everyday experiences and needs. However, our intention to use the cultural probes method was not only to gain inspirations from the cultural situation within the department. We also wanted to get a realistic account of their everyday experiences, routines and rhythms to inform our design, as done in the 'informational probes' approach (Crabtree et al. 2003). Hence, we sensitized our 'organizational probes' method to suit academic organizations in order to explore current social practices and play aspects within this setting.

Organizational probes are a set of participatory investigation tools that could provide useful information about staff members' everyday experiences within their work organizations. We applied our organizational probes over a period of 3 weeks, in our academic department. We recruited 10 participants and provided them with a collection consisting of a disposable camera, a set of colored pencils, postcards, maps, drawing pencils, a marker, scissors, glue, a set of post-it notes and three popular magazines in a probe package; and asked the participants to create a personalized workbook and a logbook of their activities. Eight of the participants were the current staff members with a mixture of PhD students, senior academics, administrative and PR members. We also asked one visiting member and one master's student to participate in this study to get a broader perspective. These participants were selected based on their availability and willingness to participate in a 6-week-long study.

The organizational probes package (Figure 1) consisted of 1) My Blog and 2) My Logbook. The My Blog assignment had pre-attached postcards, department maps and creative metaphors. Using these materials as stimuli, the staff members were asked specific questions to give an account of their everyday experiences and feelings in the department. The postcards were specifically selected to understand staff members' social status, impressions about the overall department, and their feelings about working in the academia. The department maps were provided to

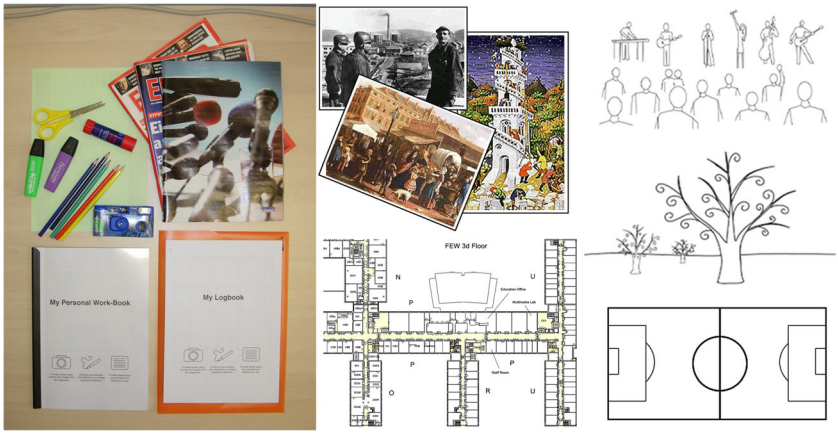


Figure 1. Organizational Probes.

understand what places were really lively, annoying and productive from a staff member's point of view, as well as to identify the most visited and least visited sites. The creative metaphors were used to access staff members' understanding of their groups and their own position in it. A set of creative metaphors were provided in My Blog, representing 'music concerts', 'tree', 'playground' and so on. Additionally, specific questions were asked in this assignment, where participants were able to use photos from the disposable camera and other stationary materials that were provided to them. For example, a task was titled: "Describe your typical week in at least 10 photos". Here the participants were encouraged to use the disposable camera.

In the "My Logbook" assignment, the staff members were asked to log their activities and feelings about these activities. This was a very flexible and open-ended assignment, where the participants had the opportunity to write about their schedule, activities and experiences associated with them.

3.3. Participants

We invited 10 participants (4 male, 6 female) from the department for our contextual inquiry and organizational probes study. The aim here was to get personal accounts of staff members' everyday social activities and their desired practices in the department. Table 1 shows the details of our participants.

4. Results

We collected a large amount of data in the form of transcribed interviews, organizational probes material, and pictures and field notes from different public spaces of the department. These data were analyzed to explore important patterns and themes. Eight staff members out of ten returned the probes completing both the assignments. The remaining two participants could only finish the probes assignment partially. We categorized all interview notes, observations and probes data and used open coding (Strauss and Corbin, 1998) to draw out the similarities and differences. In the following, we elicit the factors that played a role in staff members' practices for supporting awareness within the department.

In our investigation we found two broad themes of interaction for being socially aware of others: Self-representations and Casual Encounters. In this paper we will provide the detailed results of our study. It is important to note that these two categories should not be seen as definitive and mutually exclusive but as broad themes of interaction.

4.1. Self-representations

In the fieldwork we observed a varied set of attempts from staff members to represent and express themselves by letting others know about their choices, preferences, identity, and other more practical information by intentionally or unintentionally

Table 1. Participants of contextual inquiry and organizational probes study.

No #	Participants	M/F	Years in the department	Work dynamics
1	Associate Professor	M	15	A fulltime associate professor. Has a small research group. Teaches 3 courses in a year and works closely with master's students.
2	PhD Student	F	1	A recently-joined fulltime PhD student. Was a master's student earlier. Works on her individual research project.
3	Senior Lecturer	F	10	A fulltime lecturer. Mainly involved in teaching. Interacts with a lot of bachelor's and master's students everyday.
4	Professor	M	26	A fulltime professor. Teaches and supervises master's and PhD students, respectively. Has been in the department for a long time and knows many people in the department.
5	PhD Student	M	2	A fulltime PhD student. Works on a national project and collaborates with colleagues from another institute.
6	PhD Student	M	2	A fulltime PhD student. Works on a national project and collaborates with colleagues from another institute.
7	Personnel Advisor	F	2	A part-time personnel advisor. Works closely with the head of the department.
8	Department Secretary	F	15	One of the secretaries for the department. Looks after 3 research groups. Deals with several people everyday. Schedules and maintains everyday activities of staff members in her groups.
9	Visiting Researcher	F	3	A PhD student who works in two different institutes. Visits her supervisor one or twice a week. Knows very few people in the department.
10	Master's Student	F	N/A	A master's student, who has been working on her thesis for a last couple of months in the department.

making their status information, personal details, announcements and expressions publicly available in the department. We term this broad theme of awareness as – self-representations. Staff members utilized different publicly available tools, artefacts, place holders and devices as carriers for mediating information about self-representation. These artefacts and devices included notice boards, the staff room door, the printer room door, post-it notes attached to one's own office door and other artefacts available in common areas. The purpose of self-representation varied from supporting work-related to personal and even sentimental aspects. Using examples

from the field, we will describe different rationales for supporting self-representations. The activity of self-representation was mainly found in the form of asynchronous interaction, in which senders could publish their information in a physical or digital form and receivers would come across these via their habitual activities at work.

4.1.1. *Announcements*

The most prominent pattern in the self-representation theme was creating announcements. We observed that in several public places such as the staff room, corridors, the printer room, and in the canteen, staff members placed information pertaining to different activities, occasions, and news. The placement of these announcements were seen on notice boards, office doors, and on other 'place holders' found in public spaces of the department. For example, on the door of the staff room (Figure 2) a set of informative material was placed intentionally to make co-workers aware of certain information. In this particular example, one can see indications about a staff member's win in a local marathon, an announcement of a music concert in the city, evocative educational news clips from magazines, sharing some personal experiences via holiday postcards and announcing the birth of babies by attaching playful

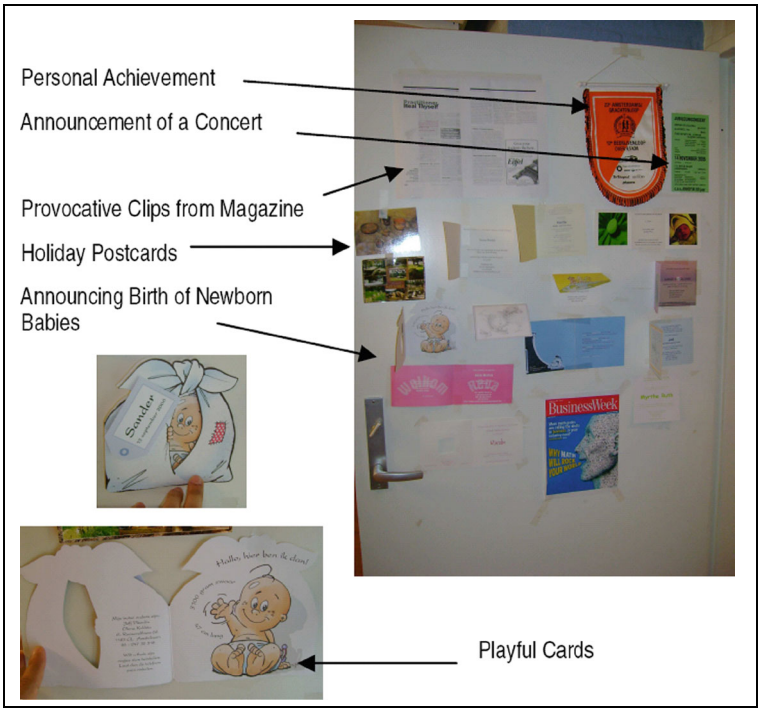


Figure 2. Self-refection objects found on the staff room door.

cards. This way the surface of the staff room door was used as a 'tool' to support social interactions with the department members by making use of announcements. Interestingly, the purposes of such announcements were not to support any work-related activities but, for example, to provoke staff members' discussion regarding the article from a magazine, to spread 'happy' news of a staff member giving birth, to announce a personal achievement of winning in a city-wide marathon, or to announce an upcoming event of a music concert in the city. The aim behind placing such announcements was not limited to simply communicating information with others but to evoke emotions and social belonging by representing the information artfully and resourcefully.

The selection of the location, modality and representation of information, and cultural practices within the department were carefully considered by staff members before displaying such information. The staff room was a frequently visited place within the department. In Crabtree and Rodden (2004)'s terms, the staff room was a 'prime site' for supporting communications among staff members. It contained post boxes of all employees within the department, a fridge, a microwave oven, a fax machine, a small printer and a set of coffee machines. Hence, for several different reasons staff members visited the staff room in a typical working day. Utilizing this 'multi-functional' character of the staff room, staff members started using the entrance door of the room for placing important announcements for others. The attributes of a location affect both how suitable it is for information display and the kinds of information left or placed there. The modality and representation of announcements were also seen as compatible with the affordances of placeholders such as notice boards and office doors. The kind of informative artefacts that were seen on different placeholders had paper-like form that was easy to attach to the vertical surfaces. The portability of these artefacts was also relevant here. Although these artefacts were infrequently managed, some staff members did change and replace their announcements to make way for others or add a new artefact to the public space. The staff room had a large physical space where some staff members come to chat while having a coffee break or having lunch with others. It was also a common practice to go to the staff room to celebrate birthdays or other occasions with fellow staff members. Hence, placement of announcements in such places would attract more attention. Staff members took into account the attributes of a location that would affect both how suitable it is for information display and the kinds of information left or placed there.

Overall, the example of the staff room door surface showed non-critical but evocative, affective and highly personal information pertaining to different staff members who chose to place this in the public space. Some of these pieces of information were used as 'news' material and some were kept as infrequently updated information that certain staff members aimed to display in such a public location, where it could attract attention and comments of other staff members and guests who might visit.

Semi-private sites. In addition to utilizing the 'prime sites' within the department, staff members also used their semi-private locations such as their individual office

doors and notice boards close to their offices to announce different types of work-related as well as non-work information. We observed that announcements related to staff members' availability, work notifications, appointment making, networking and other official announcements were made in a playful manner. Staff members advertised conference calls, research posters and group profiles in public spaces to initiate networking between different groups. Figure 3a shows an example of a notice board close to one of our participants' (an associate professor) office. This notice board was a shared resource for all the nearby office bearing staff members, but there were no official rules about how it can be used or shared between those staff members. During our contextual interviews, our participant elaborated on his use of this notice board. He used this notice board to showcase the work of his research group with a large poster describing different projects he was running, his upcoming book, some announcements related to teaching and so on. His intention to showcase his work and research was to let other members know about his expertise and explore collaborating partners for potential joint projects. Parts of this notice board were used to provide information about student internships in a company, and a job fair among other things. This part was intended to inform students of any potential opportunities. According to him, the large poster had been there for some time whereas other items on the notice board such as job and internship adverts and other specific announcements about his teaching were changed over time.

The example in Figure 3b shows an inside view of the office door of a department secretary. She managed three research groups within the department and was handling requests from several staff members at once. Professors and other staff members would come to her office for different reasons including for scheduling

Figure 3. A notice board describing work activities and projects of a senior researcher, used for networking purposes (**a**), a door full of post-it notes used for notifications (**b**) and a message written on post-it (**c**).

meetings, notifying updates and requests, and for other official and administrative purposes. On most occasions emails and phone calls were used to make requests, but several staff members (especially the ones who were at a closer proximity) would just come in to make requests in person.

In a usual scenario, when she had to leave her room, she would use relevant post-its from the inside of her office door (Figure 3b) and stick them on the front side of her office door. As one can see in Figure 3b, over a period, the secretary had collected a large number of post-its to be able to use them again. In most cases, a generic post-it note is placed, such as "will be back in 1 hour". On certain occasion, post-its might be intended for specific people with important messages, such as "Hans, your flight is booked." At times, reading these post-its intended for different people led to an understanding of her availability and presence but also gave indications about other people's activities to people who were not concerned. However, such a practice also led to giving out unintended information about staff members. The secretary's desire to support awareness heavily influenced her work practices. The following is an account from her during the contextual interviews:

> "*I always work with the door open. It is as if I cannot work with the door closed, unless I am in a conversation that is very confidential or private. If staff members who frequently walk by my office saw that my door was shut, then they would think that I am not at work. So, I have to make sure that my door is always open to show to others that I am available. In other cases, I would just leave a post-it note on my door to let others know what I am up to.*"

Additionally, her office was situated at a place very close to the staff room and rest rooms, so that staff members would routinely pass by her office and if they had some requests, they would just go to her. Hence, she needed to make sure to let others know about her status information. As shown in Figure 3b, she used a set of pre-written post-it notes to manage her time and notify others about what she was doing and to provide her status information. Most common notes would look like the one shown in Figure 3c, which states "Naar Hoofdgebouw" meaning "to the main building". Both Dutch and English versions are written on the same note to inform local and international employees.

In other cases, we observed that staff members also applied playful ways to remind others and inform colleagues about their work-related information, e.g., putting funny messages on post-it notes and placing them on the office door to playfully provide status information. We also found commercially available playful objects that could provide information about a staff member's status information (Figure 4). This playful way of broadcasting information helped staff members to support their everyday activities. While we noted that most announcements were not time critical (e.g., alerts) they supported interactions related to social and work-related awareness. We found announcements to be an important tool for smoother functioning and micro-coordination of staff members. One of the flexibilities

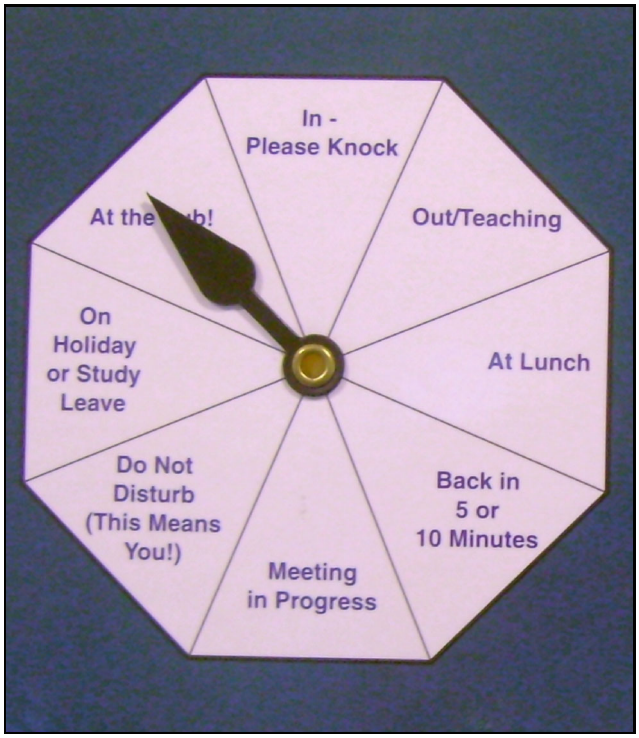


Figure 4. A playful object found on the door of a participant. The object is used to make visitors aware of the participant's current status.

supported by self-representations was their reconfigurability. Staff members could, at anytime, publish their information in a place that is publicly reachable and in the same way could take the information back if they wanted.

4.1.2. *Personal and social expressions*

The organizational probes approach helped us explore the aesthetic, expressive and emotional side of staff members' everyday work. With our probes approach, we received a large amount of data expressing staff members' identity, social and emotional status, and their interpersonal relationships. Our probing approach provoked staff members to reflect on themselves in the department and reflect on other members and the department at large, following the 'care rational' described by Bødker and Christiansen (2006) on understanding awareness. In this section, we do not provide instances of staff members' awareness practices but provide examples of their inspirations within the department.

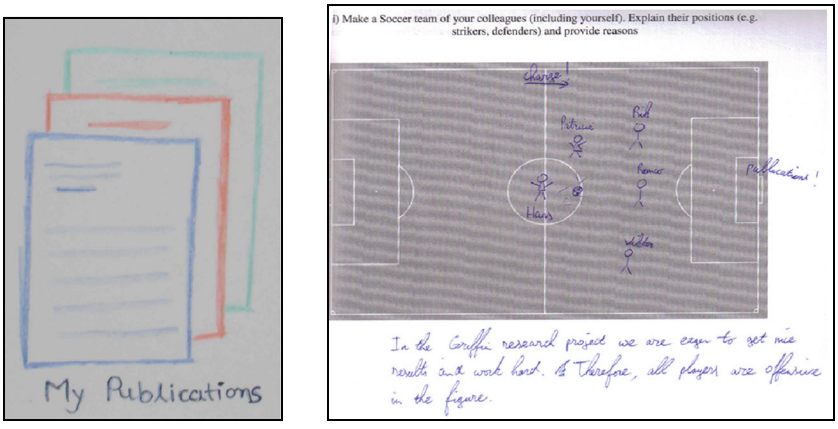
One of the most important aspects that came out of our organizational probe study was the fact that staff members did not see the department from a functional and utilitarian dimension but as a place where affect, pleasure and inspiration interweave

with the utilitarian aspects of their everyday work. In particular, we observed several instances where staff members attempted either to convey their identity as a group or to express themselves individually. In the organizational probes we asked questions such as: "how would you like to be remembered in the department?", "how do you conceptualize your group to be?" We also gave them different graphical metaphors (a tree, football pitch) and asked them to choose the most appropriate one and place their group members in it. Interestingly, we collected a lot of data representing the academic culture of the department. Figure 5a shows a doodle drawn by a participant representing his professional status as an author. Figure 5b shows another example of a PhD student who selected a football pitch metaphor to represent his group's work with the aim to score 'publications'. He placed his group members as fellow players who help each other to make these publications. The subtext reads as follows:

> "*In the Griffin research project we are eager to get nice results and work hard. Therefore, all players are offensive in the figure.*"

These two examples represent how in academic scientific publications are important and how this fact shapes researchers' own identity and a perception of research in a group.

Our probes method also collected a lot of insights into aspects that bothered staff members. The example in Figure 6a shows a personal thought which has strong emotional sentiments for one of our participants. Figure 6a is a representation of a well-known art piece called, Souplesse originally created by a French artist Chaïm Soutine (1893–1943). The image has a great personal value for a senior researcher who came across it while he was a PhD student. He reproduced this image as an



a b

Figure 5. Expressions conveyed by staff members.

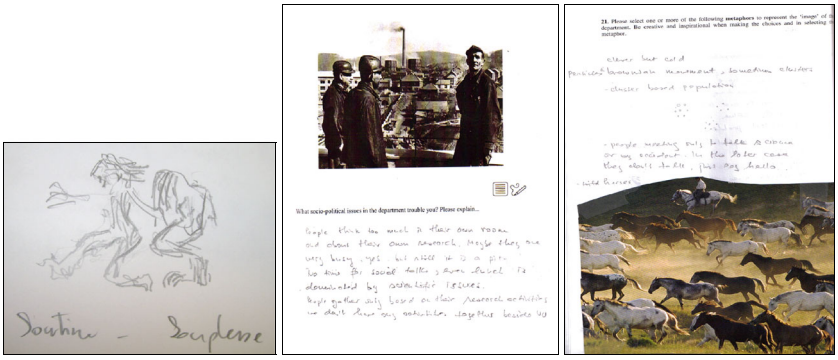


Figure 6. Personal expressions and thoughts conveyed through different means.

answer to a question: "how would you be like to remembered in the department?" The examples in Figure 6b & c show a level of frustration expressed by one of our participants about the 'lack of social interactions' among the staff members. The notes on these two examples show how staff members are not able to interact with each other and express 'pity' that members mainly interact within specific boundaries. The example in Figure 6c titles 'Clever but Cold'. In this case, the participant attached a magazine clip of running horses to express how staff members saw everything as a 'horse race' and interacted only in their own clusters.

4.1.3. *Identity and ownership*

The notions of identity and ownership were integral part of the self-representation theme. Our field study was limited to the public spaces of the department, where most of the resources such as the coffee machines, post boxes, printers, fridge and microwave oven were accessible to all staff members freely. So, clearly there were no mechanisms by which staff members could claim ownership of these publicly available resources. However, we did observe several examples where identity and ownership were conveyed. During our observations, we noted that staff members created and placed information and artefacts to make a reference to the ownership and identity of specific people in the department. Different approaches and representations were used to display who the information was from and who it was meant for. There was an observable level of 'directionality' attached to the information. There were different rationales used to convey ownership in the department.

Figure 3a was an example where a senior staff member used a notice board outside of his office by placing and showcasing information about his work. More interestingly, such a way of presenting information to others indicated a level of ownership too. The presumed ownership of the notice board, as well as the ownership of the information – what it is about and to whom it is intended. The example in Figure 7a shows a milk carton in a fridge with a post-it note with a shortened name of a person

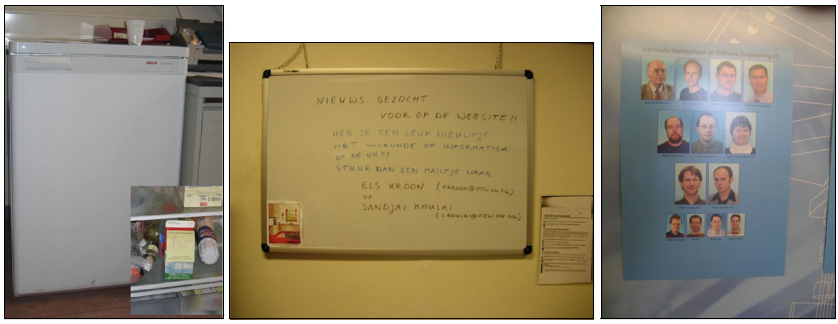


Figure 7. Examples of ownership. **a**) a milk carton with a post-it note in the staff room fridge, **b**) A PR officer's announcement on the notice board in the staff room: It says, roughly, "Please, send us 'nice' news to put into our website", and **c**) a hierarchical representation of staff members in a research group.

referring to the ownership of the carton. For a shared fridge in the department's staff room, this was a practice not only to secure a food product but also indirectly and unintentionally provide cues for the owner's presence in the department. The example in Figure 7b, shows a notice board placed at a central area in the staff room. The notice board has a heading in Dutch "nieuws gezocht voor op de website", which literally translates as "looking for news items for the website" and the notice was placed by a PR officer who wanted to collect news items from the staff members for the department's website. News items such as a best paper award, an accepted project grant, interviews and other types of news material. There was an email sent out to the staff members for the same purpose, but this notice board had the purpose of reminding staff members. Generally, staff members would refrain from using this notice board, although there was no strict rule about the use of this notice board. This notice board was often used by the admin staff members and it was specially intended for the staff members and its situated-ness within the staff room was quite appropriate. The example showed a level of urgency and importance. The notice board, here, because of its situatedness, showed location-centric messaging. The location of the notice board determined what kind of messages can be placed there.

Figure 7c shows a framed image of staff members pertaining to a particular research group. Images such as these were placed on the corridors of the three floors of the department. It also showed a hierarchical representation of participants. This was commissioned by high level officials of the department and could be seen as a way for a new member to find out 'who's who' in the department. In particular, the way in which this legacy information was represented in the corridors of the department, would provide people walking by with the status of individual staff members in the department.

In Figure 7a, we saw that ownership of a particular object was conveyed using a post-it in a publicly accessible fridge. And the examples in Figure 7b and c showed

how specific placeholders, due to their situatedness, determined what kind of information can be placed there, hence, in this case, the ownership of information and object was not as important as the value and meaningfulness of the location. In all these examples, we observed that, it was the location that determined what kind of information should be placed where and who the information should be directed to.

4.1.4. *Discussion: awareness and self-representation*

- **Public Availability**: The notion of 'public availability' has been greatly explored within the CSCW literature (Heath and Luff 1992; Robertson, 2002; Schmidt 2002). The central issue in public availability is about making artefacts and human actions publicly visible or available so that others involved in a joint activity can unobtrusively pickup such information and adapt their own activities. The connection between awareness and public availability in our study was that when certain information or data was made publicly visible e.g., postcards placed on the staff room door, it allowed other staff members to view them and know about specific updates. The issue of public availability is closely connected to the "displaying" aspect that we referred to in section 2.1. In the context of our study, staff members may not be involved in any joint work-related activities, but the public availability of specific objects led others to become aware of certain staff members and their activities. In particular, the postcard attached to the staff room door made other staff members aware of non-critical and interpersonal aspects related to a specific staff member. The post-its from the staff secretary had some connection with work-related activities as it made specific staff members aware of her availability and whereabouts as well as the status of some tasks that were assigned to her, e.g., a post-it stating "Hans, your flights are booked." In our findings, we can say that self-representation was used as a tool by which public availability was achieved.
- **Timescale**: Another interesting aspect of self-representation was about timescales. In terms of timescales, there was a clear difference between self-representation objects such as a post-it attached to an office door and a poster attached to a notice board close to a staff member's office. The use of post-it was for a short-term and immediate purpose, where a staff member wanted to inform certain people about her availability. From contents and applicability point of view, such information had a very narrow reach. Whereas the poster on a notice board had contents that defined activities over long periods in terms of projects and achievements. A research poster has a much wider reach from content as well as applicability point of view. Importantly, the issue of timescale affected the modality of objects used for self-representation. Objects such as a hierarchical representation of staff-members in Figure 7c had a lasting impact (to an extent, though), hence it was framed and placed on corridor walls so that others are made aware of the seniority level.

- **Intention**: Some conceptualizations of awareness emphasized on its implicit nature while others focused more on the explicit and conscious nature of awareness. Our results showed that self-representation was an explicit and conscious act by which staff members conveyed their status and activities. Staff members intentionally left post-its, postcards, posters, among other things on relevant placeholders so that other members can see and be informed about it.

4.2. Casual encounters

We found in our field study that most staff members had limited time for explicit social interactions while working and that most encounters were initiated and defined by either some kind of routine activities or some spontaneous actions. Casual encounters were a kind of interaction, where staff members, during their everyday activities, intentionally or unintentionally, interacted with other members and objects within the surroundings that provided hints and cues of other's awareness. Casual encounters had both direct and indirect forms. In the direct form of casual encounters, staff members could monitor and gather cues about different activities in the department by bumping into each other or meeting random staff members in the staff room. Several examples of direct communication were seen, e.g., informal gatherings in the staff room, casual staff room chats, chatting while queuing in the canteen and the printing room. Through these verbal and visual encounters staff members received information about others. These communications included information about professional activities as well as personal and social activities. These were not well-planned, explicit acts of communication but cues and traces about these actions were continuously monitored by the staff members. In the case of indirect encounters, staff members gathered cues from their physical surroundings and objects within those surroundings. Examples of indirect forms of casual encounters included getting cues from post boxes, print shelves and others. We will elaborate on this part in the coming sections. Figure 8 shows several instances of direct and indirect casual encounters that we noted during the naturalistic observations. In the following parts of this section, we will elaborate on casual encounters with some examples.

4.2.1. *Daily routines*

During their everyday activities in the department, staff members implicitly select specific pathways and locations. These locations develop social meaning over time, and become an important aspect of staff members' routines. Staff members rely on their knowledge of 'departmental routines' (their own and those of others) as well as of main traffic paths and common areas to find suitable places for information. These daily routines played an important role in allowing staff members to display and monitor cues, traces and signals around the department. Using maps and describing their everyday life in camera pictures, staff members reported several aspects of their

Figure 8. Everyday Casual Encounters. Direct and Indirect interaction with people and objects in the department.

playful practices where both 'space' and 'place' played an important role. Here space refers to the spatial and geographical locations and place refers to socially meaningful and experienced spaces (Harrison and Dourish 1996). The staff room was a common place for most social activities within the department, such as celebrations of different social events - employees' birthdays and celebrations after getting funding for a new project. Normally, in this case the staff member would use email to announce this to his group or friends.

When staff members know the routines of other members – what are the most frequently visited places, where devices such as printer, fax machine, microwave and fridge are, staff members can use this knowledge in deciding where to leave and find cues and traces of other members. As Tolmie et al. (2002) found, "routines are resources for action, and knowledge of others' routines can be resources for interaction". To give an example, Figure 9 illustrates an account of a staff member's routines in the department. Using a geographical map of the department (provided

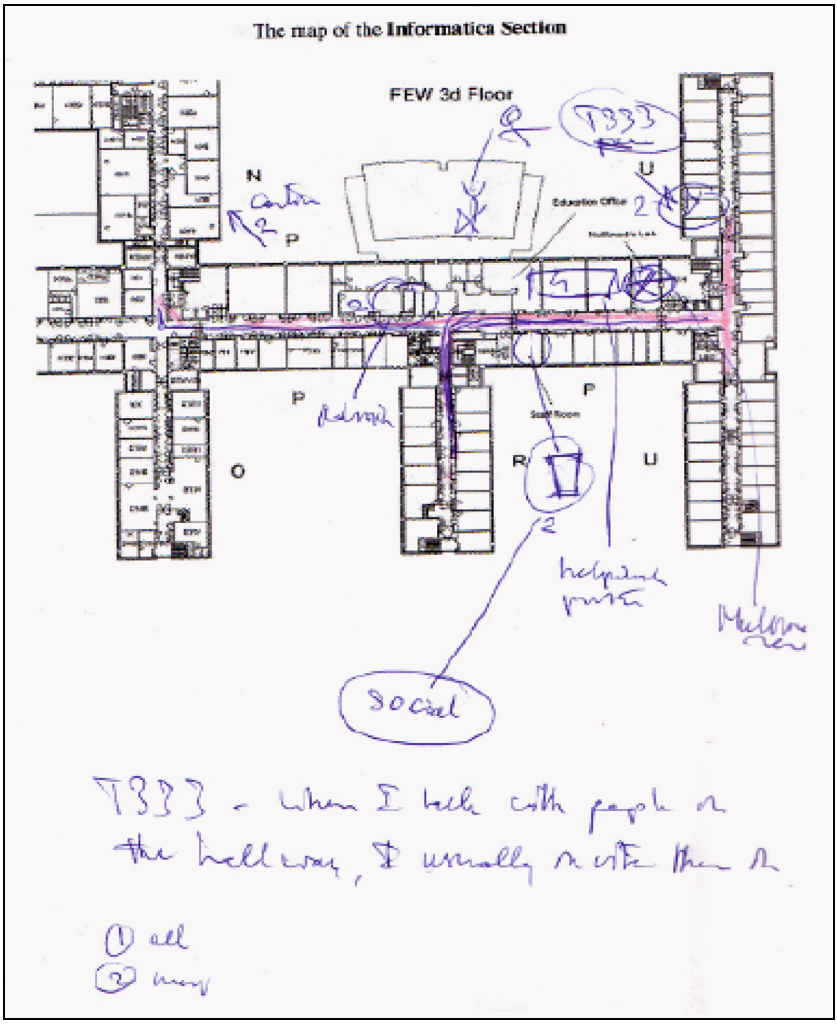


Figure 9. A staff member's representation of daily activities on a geographical map.

within the organizational probes study) the staff member provided details of his everyday activities, routines, meeting spaces and frequently visited locations within the department. Among the most common was the staff room. In the figure, the word 'social' referring to the staff room does suggest the importance of that place for having social interactions with other members.

Interestingly, a majority of staff members tied the notion of casual encounters to physical location. For example, staff members would typically make a strict distinction about where and what kind of messages and images to leave on the shared corridors, and what to keep within their own private or partially-shared office space. To make the point about the importance of routines in displaying and monitoring the

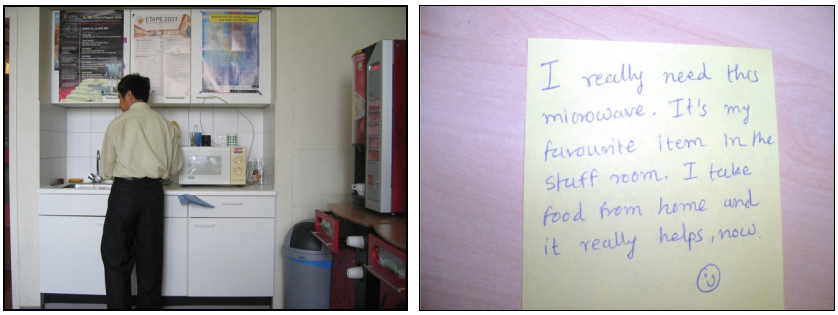


Figure 10. The microwave oven in the staff room (**a**) and, a scrap from a foreign employee (**b**).

cues and signals about staff members' activities, we provide an example shown in Figure 10a. It is a photo captured by one of our participants using the disposable camera that we had supplied with the organizational probe study package. As one can see in the photo, close to the microwave oven, which was frequently used by different members; informative artefacts such as research posters and calls for papers were placed in the knowledge that while waiting for the food to heat staff members can have a look these informative artefacts. As one participant said "*I might just have a look at these posters while I am waiting for my food*." In addition, media and technology such as the fax machine, and printer also attracted the placement of awareness-related information. Since these technologies were less portable. For example, as shown in Figure 10b, some of the technologies become really important for staff members and their visits to these technologies become regular. Similarly, the fax and prints are kept close to the fax machine and printer shelves, respectively, so that members would come to these devices, which would eventually increase the chances of casual encounters with other people.

There were several indications where the spatial layout of different work spaces influenced the structure of staff members' interaction. As one can see in Figure 11 – a picture taken by one of the participants as the part of the organizational probes study, a staff member's office would become a meeting 'place'. Harrison and Dourish (1996) made a distinction between the notions of 'place' and 'space'. Whereas space is limited to geographic and physical location, the notion of place is used to define the way space is used by people taking into account social norms and their everyday practices. Here the physical space was transformed into a place through social means. Space and place aspects also facilitated the 'forms' of interaction between the staff members. A physical location (space) and its situatedness (place) allowed members to interact with each other in an asynchronous way, where one could leave objects such as poster, conference calls, and post-it notes in a specific environment and interact with others in a physically-mediated way.

Figure 11. An example of space and place.

4.2.2. *Physical cues*

There were also several physical cues found in the public spaces that would indicate staff members' presence and activity level within the department. The example of a playful object situated at the office door of a staff member (Figure 4), showed a direct and precise information about the member's presence at a particular time. However, there were several examples where 'unintentional' physical cues helped members to gain information about other members' presence. During routine visits staff members were able to view the post boxes, print shelves, fax documents in their respective situational environments. By looking at these physical cues, staff members can guess or make inferences about other people. Two examples of physical cues can be seen in Figure 12. The full post box of a staff member could mean that he or she has been away from work or too busy to pick up their posts. And the empty post boxes may mean that the staff member has already collected their post. In either case, the physical cues can provide useful information about a staff member's presence and activity level in the department and allow others to coordinate their activities. This could mean that another member might not expect to speak with this person either because he or she is too busy or is not at work at the moment. Hence how the person can be approached can be determined by this. The example of print shelves also has a similar connotation. The department has a separate printing room that was shared by all the staff members of different research groups. The prints are arranged based on the alphabetical order. The printing shelves were cleared every morning and all the uncollected prints were stacked in a corner. This was a very common knowledge in the department. This could lead to a fair assumption that if there were a large number of prints on the shelf associated with a staff member, the member is present in his/her office and may have a high activity load. In some cases, we also saw that staff members would come to the printer room to guess if a person was at work or not.

Figure 12. Indirect mediation of awareness: staff post boxes and print shelves.

Both of the examples of physical cues may not be seen to provide an accurate indication of awareness and staff members would have to guess in many cases.

We observed that locations include meta-data for communication information by providing awareness cues for staff members. Awareness cue about specific staff members can be important for scheduling and coordination work or other activities. The presence or absence of an object from its routine location could also provide information, especially awareness information. For instance, many of our staff

members referred to knowing whether or not some of their colleagues were home or not by these physical cues.

4.2.3. *Discussion: awareness and casual encounters*

The important aspect in casual encounters is that it is focuses more on specific places (or 'prime sites') where encounters take place than on people who are involved in such encounters. Several of the examples that we discussed here are not so much about person-to-person encounters, but indirect 'encounters' through the traces of 'past' activity or as shown in the case of pigeon holes and print-outs, effectively 'future' ones. Daily routines play an important role in this. Routine can be a *resource for awareness*. Through routines, staff members were able to be aware of certain things or certain people in their environment. Their everyday routines allowed staff members to pick-up cues and traces of others, which were likely to be interpreted. For example, in the case of a pigeon hole, if someone regularly picks up mails then the fullness of the mail box with posts would mean that the person is likely to be unavailable. These kinds of interpretations are only possible through staff members' routines over time. It is because routines are also the resource for encounters; they allow staff members to be aware of others. For example, going to the same place means that staff members are more likely to meet with others and in doing so likely to know more about others by chatting with them.

Based on our results, casual encounters can be further categorized into four sub-classes, based on asynchronous vs. synchronous modes and intentional vs. unintentional modes, as can be seen in Table 2.

Asynchronous & Intentional. This class refers to instances where staff members encounter objects such as notices or announcements attached to publicly available placeholders. Here the crucial thing is that the person leaving the message has an explicit intention to communicate and possibly prompt actions. These objects become an intentional part of supporting casual encounters.

Asynchronous & Unintentional. This class refers to instances where staff members encounter cues and traces either directly through their presence in the environment (e.g., posts in pigeon holes), or, as in the case of print-outs, by the actions of others or automated processes that are related to the person's future presence in the place. Other people may then become aware of the first person's activities, either consciously, and in the latter case accidentally, or maybe intentionally – for example, deliberately looking at a pigeon-hole to see if the person has been about.

Table 2. Sub-classes of casual encounters.

	Intentional	Unintentional
Asynchronous	Notice-boards, Announcements	Posts in pigeon hole, Print copies
Synchronous	Talking	Seeing, Overhearing

Synchronous & Unintentional. This class refers to instances where staff members see or overhear each other by the virtue of being in the same locations or prime sites. They do not directly interact or explicitly communicate with each other, but could unintentionally and often unconsciously gather information and awareness about others and their activities.

Synchronous & Intentional. This class refers to instances where staff members are in the same place at the same time and explicitly communicate and develop awareness of certain things. As well as all the implicit cues about each other's activities, the conversation may convey awareness information about each other and the wider organization.

5. Discussions and implications

Can an organization afford social awareness? In the paper titled "Can organizations afford knowledge?", Anderson and Sharrock (1992/93) highlighted that the management of physical space and the analysis of workplace artefacts (such as paper invoices) can provide useful information about an organization's routines and work practices. In our work, we did not focus on understanding how the professional work is being carried out, rather, how staff members became socially aware of one another. Our results showed that the spatial layout of our department and staff members' tacit knowledge about their workplace were of great importance. The two generic themes of interactions, self-representations and casual encounters, that we explored from our fieldwork showed that staff members, through adaptation of their practices and use of spatial resources, devices and tools (such as notice boards, the staff room door), conveyed their status, identity, behavior and activities in an implicit and unobtrusive but a skillful manner. The 'public availability' of these spatial resources played an important role in supporting awareness. Moreover, the notion of boundary became visible, i.e., staff members carefully chose certain location and placeholders to convey specific information. Staff members used notice boards in the close proximity of their offices to convey their research interests and advertise information relevant for students, whereas the staff room door was used to communicate information of personal nature such as a birthday card and holiday photos. The tacit knowledge about the department and its routines that staff members developed over a period enabled them to make clear distinction between the use of different placeholders in the department. The example discussed in Figure 7b showed a notice board at a very central location of the staff room that was generally used by the admin staff to make important announcements for the academic staff members. Even though there was no strict rule about using this particular notice board, it was mainly used by the admin staff.

In Anderson and Sharrock's (1993) terms, the tacit organizational knowledge developed by staff members allowed them to adopt a certain behavior to suit different social interactions within the department and utilize a diverse set of spatial ecology.

In the case of the staff room, staff members were familiar with different sets of facilities it afforded, ranging from taking a beverage from a set of coffee machines that were positioned in the staff room to the use of other facilities such as fax machines, microwave, post-boxes and so on. Our organizational probes exercise (Figure 9) also showed that the staff room had as much a social role as it had a functional importance for the staff members. Staff members had developed their own habits and routines that led them to make inferences about somebody's presence and availability in the department. In addition to receiving 'intentional' cues about different announcements and advertisements that were positioned at specific locations, there were also several 'unintentional' cue that were being used to support awareness. These unintentional cues were in the form of post boxes full of mails and printer shelves filled with recent prints which would lead to indicating the presence of particular individuals. Both of these examples were part of the department's common practice. In the case of printer shelves, the knowledge that every morning the shelves are cleared and any new prints left on these shelves will be from the present day would lead to making certain assumptions about staff members' presence and availability in the department.

Overall, our fieldwork did provide some understanding about how an organization can afford social awareness. The themes of self-representation and casual encounters are the two ways social awareness was being supported, where the use of spatial resources and tacit organizational knowledge were being utilized. The fieldwork also showed that the notion of awareness goes beyond supporting productive and task-oriented information and encompasses the playful, social, and other personal aspects of staff members' everyday lives. The two broad themes showed that awareness is conveyed through staff members' routine activities in an unobtrusive and implicit manner.

5.1. Design implications

From our field study results, we elicited two main themes, Self-representations and Casual Encounters, which have direct implications for designing a tool to support awareness within our academic department. One can see several ways of implementing these two themes in interactive technology to support and maintain awareness in organizations. We briefly describe ways to apply these two themes.

Self-representations: From the fieldwork, we explored the ways artefacts and messages were being attached to the staff room door (Figure 2), notice boards and similar locations so as to playfully-mediate personalized contents to make other members aware. When developing a new technology, self-representations can be seen as an explicit mechanism for supporting user-driven interactions. For staff members this means that they can contribute towards the environment through their personal and non-critical information or data and make other members aware of their activities and interests. The technology can serve as a tool that allows staff members to support their social needs, such as sharing non-work-related news,

personal achievements and personal interests. In this case, the technology does not simply receive feeds passively from users. It can, in fact, tweak, filter, alter contents and represent them in an enjoyable and playful manner.

Casual Encounters: From the fieldwork, we observed that staff members, in their routine activities, 'bump into' each other and intentionally or unintentionally convey and collect information about their presence, status and activities. The theme of casual encounters can be realized when the technology proactively pushes information about the ongoing activities within the department and by offering resources of potential interest from the environment. This should definitely not interfere with staff members' routine activities nor should it mean that staff members need to reduce their public-view activities. On the contrary, this way of supporting casual encounters can provide an added value to the departmental social environment, especially, during heavy workloads and frequent time-clashes physical interaction between members is not possible. The technology can serve as a mechanism by which staff members can be socially aware of each other by knowing their presence, social events and relevant non-critical activities within the department. In this case, even though users passively receive information from the technology, they can actively comprehend the implications of their action (either alone or in groups) on the technology.

6. Panorama – an awareness system

Utilizing the findings from our fieldwork, we developed a system called Panorama (Figure 13), which is a situated display placed in the staff room of our department.

Figure 13. Panorama system situated in the staff room with camera sensors placed in public areas of the department such as the corridor.

Panorama is meant to enhance awareness by displaying non-critical and non-work-related information about staff members in an interactive manner. A detailed description of the system and a field trial of Panorama are described elsewhere (Vyas et al. 2011). In this article, we will briefly describe the design of Panorama and showcase how it uses the results of our field study.

Note that Panorama is not intended to replace any of the physical mechanisms described in our fieldwork findings. Neither is it meant to directly support or extend these mechanisms; one could envisage tangible devices which might function in this manner, but this was not the intention in deploying Panorama. Instead, Panorama is intended to complement the existing physical awareness mechanisms, supporting some of the deep awareness needs identified and using the insights gained form the field study, but realized in a different way making use of some of the potential of a digital technology.

Panorama attempts to mediate awareness cues through visual and textual information. Its design is informed by the two themes developed from our fieldwork: self-representations and casual encounters. These design implications are supported by the following means:

- Self-representations – staff members can send images, video and text messages pertaining to their personal, and social activities to the system. These items are displayed in a semi-artistic fashion on the large screen of Panorama as a continuously moving sequence. This way Panorama allows members to express their interests, thoughts and sentiments.
- Casual encounters – Panorama collects information from the department using wireless cameras – placed around the public areas of the department and represent this information on its screen in the form of video streams and images. In this way, it captures different encounters from the physical environment of the department and presents them on the large screen. The cameras are used to detect the activity levels in the common area within the department is represented on Panorama through the change of speed, color, abstractions (e.g., using shader) and overlays of 3D objects and particles.

For designing Panorama, we utilized an existing technology called Virtual Poetry (ViP), which was originally developed for creating an augmented reality theater production (Eliëns 2006). ViP is a complex representation system based on DirectX9. It allows projection of live video feeds, digital video clips, texts and sequences of images on an immersive 3D space. The ViP system also allows a variety of visual effects, including texture mapping of image feeds on 3D objects, overlays of multiple image textures, as well as particle systems with streaming image feeds projected on sprites. ViP can be seen as an umbrella platform for representing different visual information, where representation style can be adapted to suit a particular need. For conceptualizing the Panorama interface, we adapted the representation of ViP to show a *continuous* and *always on* interaction. As Figure 13a shows, there are two planes of the Panorama interface, both presenting visual

information floating in opposite directions – providing a feeling of *walking through a corridor*. Panorama can take inputs from nine different channels, which are shown at the bottom of the Panorama interface. This, in a way, informs the staff members what to expect on the vertical plane of the Panorama screen. The speed of flotation of the images is adapted from the sensor information in real time. When cameras in the public area detect an increase in people's movements, then the speed of visuals on Panorama increases. This particular functionality is devised to indirectly inform staff members about the activity level in the department.

We carried out a field trial of Panorama over 2 weeks in our department. Full details of our study are described in (Vyas et al. 2011). Overall, we found that Panorama simulated curiosity and learning, initiated new interactions and provided a mechanism for cherishing memories within our department. Panorama was conceived as a 'calm technology' (Weiser and Brown 1996). At times, Panorama became the center of attention and a topic of discussion (at least, in terms of its contents) and, at times, it just ran in the background of staff members' peripheral attention. In the latter case, staff members could go on chatting and eating their lunch without being bothered by Panorama.

6.1. Reflecting and connecting the fieldwork

In this section, we will connect our fieldwork findings to the design decisions taken in Panorama.

6.1.1. *A communal resource*

Our fieldwork data showed several instances of the way different physical locations such as the staff room, corridors and other spatial resources such as office doors and notice boards were utilized by the staff members to convey information about their interests, choices and activities. In particular, the importance of the staff room in supporting several social activities and being used as a 'prime site' for supporting different activities (posts, fax, etc.) came out very strongly in our research. The design of Panorama was inspired by the fact that staff room was one of the frequently visited locations of the department and was part of staff members' everyday routines. The decision to place Panorama in the staff room was based on this. Additionally, we chose to design Panorama as a display in our staff room and not an application that can be accessed as a client on staff members' computers or mobile devices. Our fieldwork showed that staff members would walk around and gather information from different objects and people in order to create their awareness about different things. This way, Panorama was meant as a situated display where staff members would walk to the staff room and would gather information and social cues about others, while they carry out their routine activities. The user interface elements of Panorama were intended toward displaying the continuous flow of information in the form of different images and text messages sent by staff members. This directly connects to the self-representation theme where staff members can send visual

information that they would like to share with others. As Panorama is an always available, situated display it provides a platform for the staff members who are interested in sharing their information with others.

An important issue that we would like to emphasize here is that our intention behind the design of Panorama is not to replace the existing practices of staff members or to introduce any technological intervention. Panorama is designed to complement staff members' existing practices and work alongside these practices. Panorama can certainly not replace the joy of reading a physical birthday card of a new born that is attached to the staff room door, or capture and support all the causal interactions between staff members that would take place in the department. Similarly, Panorama does not intend to alter staff members' existing practices, everyday routines and use of different spatial resources to convey information to others in the department. The situated-ness of Panorama in the staff room incorporates the fact that many self-representational awareness cues may be around different location of the department, Panorama allows staff members the opportunity to view them in one central location when they cannot go around different parts of the department. In a way, Panorama creates a 'place' for different sources of information.

Another aspect that we would like to emphasize is that Panorama may not be able to support the level of details and expressivity that we observed in the staff members' self-representation awareness cues. Our fieldwork explored largely diverse and expressive contents that were made publicly available on the staff room door, notice boards and corridor walls. When we look at the example of a playful card (Figure *2*) attached to the staff room door and the expressive object indicating a staff member's presence (Figure *4*), it becomes obvious that Panorama would not be able to replicate the contextual significance of such expressive objects. Panorama being a digital technology does have its own advantages which manual practices may not afford. Panorama can support a large amount of images, videos and text messages that can be continuously played over and over.

6.1.2. *Social networking services vs panorama*

Social networking services (SNS) have the potential to support awareness between people. Facebook, Twitter, LinkedIn and other SNS services can convey information about people's ongoing activities, whereabouts and social connections with others, which can serve as useful awareness cues. As mentioned above, our intention behind Panorama was to provide a communal resource where staff members can access information that can enable them to be socially aware of other staff members. Panorama was not intended towards enabling staff members to create their own 'social networks'. This was an explicit design decision we took based on the data from our fieldwork. As we showed in section 5, awareness cues, be they part of self-representation or casual encounters, were rarely directed towards specific staff members. Because these cues were part of public availability, they could be 'picked' by any staff member who may encounter them. Panorama falls into the category of 'awareness displays' such as the Whereabouts Clock – a display used to locate family

members (Sellen et al. 2006a, b) and Hermes – a situated, office-door display for workplace awareness (Cheverst et al. 2009).

The work of DiMicco et al. (2008) showed that professionals working at a large organization use SNS to support 'building stronger ties' between professional and 'reach out' to newer employees in the organization. Panorama does have the potential to support these two features, in a sense that when a staff member uploads his or her content to the Panorama screen it can reach to several staff members who visits the staff room and spends some time looking at the Panorama display. The personalized and sociable contents uploaded to Panorama do have some attributes that can support building connections between staff members. Another potential SNS feature that Panorama can support is to become an aggregated source of information that can be used by different staff members. The work of Brzozowski (2009) among other things emphasized that members of an organization should be able to have a much broader view of their organization beyond their workgroups and expertise, echoing the work of Nardi et al. (2002). Although their focus is on the technical skills and expertise of staff members, Panorama does have the feature where it aggregates information of non-critical non-work nature in its display, which in turn has the potential for supporting social awareness and improving connected-ness within the department.

6.2. Summary

Our workplace study focused on awareness mediated by physical interactions in a physical space, whereas social networking systems are purely digital. Panorama, like other forms of situated display sits in the mid-ground, a technical augmentation of a physical space. As we have seen in the discussion above, there are many features that this mid-ground shares with purely virtual awareness. Furthermore, the methodological premise of our work is that awareness arising from natural physical interactions shares deep structures and properties with digital interventions. So, in some ways SNS, situated displays and physical awareness could be seen as just different ways of supporting the same underlying practices. However, there are also core distinctions.

There are clear situations where digital mediation has specific advantages, notably for geographically separated teams, as in the earliest media space (Bly et al. 1993). However, this was not the case for Panorama, and creating a situated display where there is existing successful physical awareness runs the risk of either (i) interfering with existing awareness practices or (ii) being impoverished in comparison. For Panorama, the first is not a problem largely due to its design as 'calm technology'. The second was avoided partly through the explicit use of understanding from the physical study, and partly through the novel features available with the digital medium.

In addition, situated displays tend to be successful where they leverage aspects of the physical environment and enhance it. For example, the Hermes door displays (Cheverst et al. 2009) took as key the individual nature of personal offices and existing practices of leaving notes on doors, but enhanced this by allowing the door

owner to post notes remotely and making the notes left by callers visible only to the door owner. In a similar way, as noted in section 6.1.1, Panorama was deliberately placed in an existing 'prime site' thus recruiting the social presence and expectations inherent in that site, but enhanced it by allowing remote addition of content. While Hermes, on personal office doors, reduced the visibility of callers' messages for privacy reasons, Panorama, in a social space, increased visibility, using video feeds to render the walls to the corridor transparent.

7. Conclusion

The need to support awareness in large organizations cannot be over-emphasized. The fieldwork in our own academic work environment has shown that self-representations and casual encounters were the two broad themes of interaction that helped staff members to be socially aware of their colleagues. We believe that these two themes are intertwined and cannot be seen in isolation. Our fieldwork has shown several interesting practices of staff members that supported awareness in their everyday work lives. Using the findings from our fieldwork, we designed a situated display called Panorama that can complement staff members' existing practices and co-exist alongside these practices. Overall, this work advocates supporting non-critical and personal interactions between staff members through the use of technologically mediated social awareness.

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